Grade 12 Biology Model Paper 2

MODEL PAPER

Full marks 75 · 3 hours

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 75

Answer every question; where a question has an OR question, answer either one. Time: 3 hours.

A practice paper by Science Playground, made to CDC's Specification Grid 2078, Grade 12 Biology (Bio. 202); not an official CDC or NEB paper. Mark it yourself online: the QR code below opens the paper with its answers.

A full practice run of the NEB Grade 12 Biology paper (Bio. 202): 75 marks in 3 hours, in two parts, Botany (37 marks) and Zoology (38 marks). Each part has three groups: group A is one question of multiple-choice items (5 in Botany, 6 in Zoology), and groups B and C have short-answer questions of 4 marks and long-answer questions of 8 marks, of two to four parts each, with each part's marks shown. Allow about 25 minutes for all the multiple-choice items and 155 minutes for the rest. CDC's paper numbers the questions of each part from 1; here they run straight through, Questions 1–7 in Botany and 8–14 in Zoology, so that every question has its own number. Questions 4 and 11 in group B and Questions 6 and 14 in group C each have an OR question: answer either the question or its OR question, every part from the same one, and mark only the one you answered. Write on paper first, then tap your choice in group A and open each other part's answer to give yourself the marks its scheme allows.

Botany, Group A Multiple choice (Botany) — 5 marks

Question 1 — 5 × 1 = 5

Choose the correct option for each of the following questions.

a. The young stems of many herbs bend in the wind without breaking. Which tissue under their epidermis lets them do this?

(i) sclerenchyma, whose dead cells have thick lignified walls
(ii) collenchyma, whose living cells are thickened with cellulose at the corners
(iii) aerenchyma, with large air spaces
(iv) cork, with walls thickened with suberin

b. What are plants called that flower only when the day is shorter than a critical length?

(i) short-day plants (ii) long-day plants
(iii) day-neutral plants (iv) vernalized plants

c. A plant cell with an osmotic pressure of 18 atm is placed in pure water and left until it takes in no more water. What is its turgor pressure then?

(i) 0 atm (ii) 9 atm (iii) 18 atm (iv) 36 atm

d. Nikita counts the bubbles given off by a water plant in a beaker. In bright light, adding a little sodium bicarbonate (a source of carbon dioxide) to the water makes far more bubbles; in very dim light, adding it makes no difference. What does this show?

(i) Carbon dioxide is never a limiting factor of photosynthesis.
(ii) Light and carbon dioxide have no effect on each other.
(iii) The rate is held back by whichever factor is in shortest supply: carbon dioxide in bright light, light in dim light.
(iv) Sodium bicarbonate slows photosynthesis in dim light.

e. By which part is ginger usually propagated?

(i) tuber (ii) bulb (iii) rhizome (iv) corm

Botany, Group B Short answers (Botany), each on one content area — 16 marks

Question 2 — 4 marks

A forester in Dang takes a pencil-thin core of wood from bark to center from a sal tree with an increment borer. On it he counts 62 rings, each a pale band followed by a narrow dark band; the wood near the center is dark and the outer wood pale.

a. What is a lenticel? **[1]**

b. Why is each ring a pale band followed by a narrow dark band? **[1]**

c. About how old is the tree? Of the dark central wood and the pale outer wood, which would you choose for the pillars of a temple, and why? **[2]**

Question 3 — 4 marks

A fruit nursery in Sarlahi supplies thousands of mango and litchi plants every year, every one exactly like its parent variety.

a. Name the method of vegetative propagation in which: **[2]**

i. a twig of a good mango variety is joined to the cut stem of a hardy seedling so that the two grow as one plant;

ii. roots are made to grow on a litchi branch, still on the tree, wrapped in a ball of moist moss where a ring of bark has been removed.

b. Kapil's uncle in Dhading has planted potatoes for many years from his own tubers, and each year his yield is lower and more of the leaves are mottled and curled. Explain why, and suggest what he should do. **[2]**

Question 4 — 4 marks

In a sample of DNA from the leaves of a pea plant, 30% of the bases are adenine.

a. Why is DNA replication called semi-conservative? **[1]**

b. Calculate the percentage of thymine, guanine and cytosine in the sample. **[2]**

c. Bacteria whose DNA has heavy nitrogen (^{15}N) in both strands are moved to food with only light nitrogen (^{14}N) and allowed to divide twice. What share of the DNA molecules would then contain any heavy nitrogen? **[1]**

OR

In the fruit fly *Drosophila*, the gene for eye color is on the X chromosome: the allele for red eyes (X^R) is dominant to that for white eyes (X^r). Repeating one of Thomas Hunt Morgan's crosses, a student crosses a white-eyed female with a red-eyed male.

a. What is meant by sex-linked inheritance? **[1]**

b. Work out, with a checkerboard, the eye colors of the sons and daughters of this cross. **[2]**

c. Why does every son of this cross have his mother's eye color, and not his father's? **[1]**

Question 5 — 4 marks

Insulin for people with diabetes was once taken from the pancreas of cattle and pigs. Since 1982 most of it has been made by bacteria into which the human insulin gene has been put.

a. What are restriction enzymes? **[1]**

b. Why must the same restriction enzyme be used to cut both the human DNA and the bacterial plasmid? **[1]**

c. Give two reasons why insulin made by bacteria is better than insulin taken from animals. **[2]**

Botany, Group C Long answers (Botany), each on one content area — 16 marks

Question 6 — 8 marks

Farmers in Japan long knew a rice disease, bakanae ("foolish seedling"), in which the seedlings grow very tall and thin and fall over. The cause was a substance made by a fungus, and the plants' own similar hormones are the gibberellins.

a. Name the fungus from which gibberellins were first found. **[1]**

b. Explain any three physiological effects of gibberellins. **[3]**

c. Riya sprays dwarf pea plants with gibberellin and they grow as tall as tall varieties. Have the plants become genetically tall? What will the plants grown from their seeds be like? **[2]**

d. A fruit seller at Kalimati keeps hard green bananas in a closed room with a few ripe ones, and they all ripen within days. Explain why. **[2]**

OR

In a hot summer in Chitwan, the maize in Manish's field grows fast in bright sunlight, while a wheat crop planted in the same weather would do poorly. Both use light energy in their chloroplasts to make sugar.

a. Name the part of the chloroplast where the light reaction takes place. **[1]**

b. Explain how the light reaction (non-cyclic photophosphorylation) produces ATP, NADPH and oxygen. **[3]**

c. Making one glucose takes 12 NADPH, and each NADPH takes two electrons from water. How many molecules of water must be split, and how many molecules of oxygen are given off, to make the NADPH for 3 molecules of glucose? **[2]**

d. Maize is a C_4 plant and wheat a C_3 plant. Explain why maize does better in hot, bright weather. **[2]**

Question 7 — 8 marks

Bishal crosses pure pea plants with round, yellow seeds (RRYY) with pure plants with wrinkled, green seeds (rryy). All the F_1 plants have round, yellow seeds. He lets the F_1 plants self-pollinate and sorts 496 F_2 seeds: 278 round yellow, 95 round green, 89 wrinkled yellow and 34 wrinkled green.

a. State the law of independent assortment, and use it to name the kinds of gametes an F_1 plant (RrYy) makes. **[2]**

b. Bishal crosses an F_1 plant with a wrinkled, green plant (rryy). Work out the genotypes and phenotypes of the offspring and their ratio. **[3]**

c. Do Bishal's F_2 numbers agree with Mendel's dihybrid ratio? Show your working, and say what this tells us about the genes for seed shape and seed color. **[3]**

Zoology, Group A Multiple choice (Zoology) — 6 marks

Question 8 — 6 × 1 = 6

Choose the correct option for each of the following questions.

a. Which two bacteria, working together, are used to make yogurt?

(i) *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus*

(ii) *Escherichia coli* and *Vibrio cholerae*

(iii) *Rhizobium* and *Azotobacter*

(iv) *Saccharomyces cerevisiae* and *Penicillium*

b. The cells of heart muscle contract together, almost as one, at each beat. What makes this possible?

(i) Each fiber has many nuclei at its edge.

(ii) The cells are joined end to end by intercalated discs, through which the impulse passes quickly from cell to cell.

(iii) Every cell has its own nerve ending.

(iv) The cells are spindle-shaped and unstriped.

c. In which part of the female reproductive system does fertilization usually take place?

(i) the uterus

(ii) the cervix

(iii) the ampulla of the fallopian tube

(iv) the ovary

d. How is most of the carbon dioxide carried in the blood from the tissues to the lungs?

(i) dissolved in the plasma

(ii) joined to the iron of hemoglobin

(iii) as bicarbonate ions, formed in the red cells by carbonic anhydrase

(iv) as carbonic acid in the white cells

e. Aayusha has eaten nothing since breakfast and walked for six hours, yet her blood glucose stays steady. Which hormone mainly keeps it up, and from which cells?

(i) insulin, from the beta cells of the islets

(ii) glucagon, from the alpha cells of the islets

(iii) glucagon, from the beta cells of the islets

(iv) somatostatin, from the delta cells of the islets

f. After a head injury, Ujwal can think and speak normally and his muscles are strong, but he walks unsteadily, sways and overshoots when he reaches for a cup. Which part of his brain is most likely damaged?

(i) the medulla oblongata

(ii) the cerebellum

(iii) the hypothalamus

(iv) the frontal lobe of the cerebrum

Zoology, Group B Short answers (Zoology), each on one content area — 16 marks

Question 9 — 4 marks

In the laboratory, Kushal soaks a cleaned chicken leg bone in vinegar for a week: it becomes so soft that it bends like rubber. His friend heats another bone strongly in a flame: it keeps its shape but crumbles when pressed.

a. Name the mature cells of cartilage. **[1]**

b. Explain what each treatment removed from the bone, and so what each part of the matrix does. **[2]**

c. Kushal twists his ankle in a football match, and the doctor says the tissue holding the bones of the joint together has been stretched. Name this tissue. **[1]**

Question 10 — 4 marks

A frog's zygote divides again and again by cleavage. The yolk lies mostly in its lower, vegetal half.

a. Why are the cells of the vegetal half of a frog's 8-celled embryo larger than those of the animal half? **[1]**

b. How many cells does the embryo have after the fifth cleavage? Name this stage, and say whether the embryo is then larger than the zygote. **[2]**

c. The embryo takes in no food from outside during cleavage. Where does its energy and building material come from, and why does this explain the size of a frog's egg? **[1]**

Question 11 — 4 marks

Saugat chews a piece of plain bread for a long time and finds that it begins to taste sweet.

a. Name the enzyme in saliva that digests starch. **[1]**

b. Saugat sets up three test tubes of starch solution at 37 °C: tube A with fresh saliva, tube B with saliva that has been boiled, and tube C with saliva and a few drops of dilute hydrochloric acid. After 20 minutes he adds iodine to each. Predict the result in each tube and give reasons. **[2]**

c. Swallowed food stays in the stomach for hours, but very little of its starch is digested there. Why? **[1]**

OR

Dawa can read his book clearly but cannot read the board from the back of the class; an eye test shows that his eyeball is a little too long.

a. Name the defect of Dawa's eyes. **[1]**

b. Explain why a distant object looks blurred to Dawa, and what kind of lens corrects it. **[2]**

c. Dawa's grandmother, who has always seen distant hills clearly, cannot read without holding her book far away. Is her defect the same as Dawa's? Give a reason. **[1]**

Question 12 — 4 marks

A health post in Dhankuta measures the blood pressure of three visitors: 118/76 mmHg, 135/85 mmHg and 152/96 mmHg. The visitor with the last reading feels perfectly well.

a. Why is hypertension called a "silent killer"? **[1]**

b. Taking hypertension as a pressure that stays at or above 140/90 mmHg, which of the three readings shows hypertension? **[1]**

c. Suggest two changes in daily life that would help this visitor lower his blood pressure, and explain how each helps. **[2]**

Zoology, Group C — Long answers (Zoology), each on one content area — 16 marks

Question 13 — 8 marks

Aastha's family in Nawalparasi has a carp pond of half a hectare. They stock it with 5,000 fingerlings of six species: silver carp 30%, bighead carp 10%, grass carp 10%, common carp 15%, rohu 20% and mrigal (naini) 15%.

a. What is composite fish culture? **[1]**

b. Explain how the six species together use all the food the pond produces. **[3]**

c. How many fingerlings of each species did the family stock? **[2]**

d. A neighbor stocks a pond of the same size with 5,000 silver carp only. Would his harvest be larger or smaller than Aastha's family's? Explain. **[2]**

Question 14 — 8 marks

A woman's menstrual cycles are regular, each 32 days long. The ovarian cycle has a follicular phase, ovulation and a luteal phase, steered by the pituitary's FSH and LH.

a. Explain the part played by LH in ovulation and after it. **[2]**

b. Ovulation comes about 14 days before the next period begins, since the luteal phase lasts about 14 days. On about which day of this woman's cycle does she ovulate? On which day would a woman with a 28-day cycle ovulate? **[2]**

c. Explain why menstruation begins when the egg is not fertilized, and why it does not happen when the woman becomes pregnant. **[4]**

OR

A medical laboratory in Pokhara tests the blood and urine of Sangam, who has diabetes that is not well controlled. His blood glucose is very high, and glucose is found in his urine. In a healthy volunteer's kidneys, the blood pressure in the glomerulus was measured at 58 mmHg, the osmotic pressure of the blood's proteins at 30 mmHg and the pressure of the fluid in Bowman's capsule at 16 mmHg.

a. Explain how the glomerular filtrate is formed. **[2]**

b. Calculate the net filtration pressure in the volunteer's glomerulus from the pressures given. **[2]**

c. Explain why glucose appears in Sangam's urine though a healthy person's urine has none, and why he passes large amounts of urine and is always thirsty. **[4]**